

School-to-Work Linkages in Texas

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This report examined school-to-work linkages among bachelor's degree holders in the state of Texas. Linkage is a measure of how closely connected college majors are to specific occupations in the labor market. Studying linkage is useful as the state works toward ensuring students complete postsecondary credentials with marketable skills. The study found linkage positively predicted earnings. Moreover, the earnings benefits from linkage were concentrated among individuals in matched occupations, or individuals employed in jobs common among people with their college major. Finally, the study found linkage negatively predicted unemployment.

Key Findings

- Workers who were older, female, Asian, foreign-born, and non-native English-speakers were more likely to complete a college major with higher linkage than workers who were younger, male, white, Black, Hispanic, U.S.-born, and native English-speakers.
- Only 14 percent of workers were employed in a matched occupation.
- Workers who were older, female, Asian, and U.S.-born were more likely to be employed in a matched occupation than workers who were younger, male, white, Black, Hispanic, and foreign-born.
- College major linkage strength and occupational match were positively related to wages. In particular, strong linkage increased the wages of workers in matched occupations more than workers not in matched occupations.
- Linkage negatively predicted unemployment.



Background

In 2015, the Texas Higher Education Coordinating Board (THECB) released the *60x30TX* strategic plan, which outlined several goals for postsecondary education in the state (Texas Higher Education Coordinating Board, 2015). While the primary goal — to increase the share of individuals 25-34 years old with a postsecondary credential to 60 percent by 2030 — garnered a great deal of attention, another goal focused on marketable skills and aimed to ensure college students graduated with skills valued in the labor market. The marketable skill goal was not only tied to students' long-term success, but also the state's enduring viability as an economic powerhouse.

Ensuring students enter the labor market with marketable skills is challenging because it may require input and systemic change from PK-12 education, postsecondary education, and employers. A prior Houston Education Research Consortium (HERC) research report addressed this question by studying which jobs were characterized by high rates of change in supply and demand (Holzman, Gul, Salazar, & Kennedy, 2020). Another way to explore the marketable skills goal is to focus on college majors which have strong connections to specific occupations in the labor market.

A recent study showed college majors strongly connected to specific occupations in the labor market paid higher wages and had lower unemployment rates than college majors with weaker connections to specific occupations in the labor market (Bol, Ciocca Eller, van de Werfhorst, & DiPrete, 2019). This finding was important because it might have implications for how students choose college majors, how higher education institutions provide guidance to students, and how employers recruit students into jobs.

Given these associations, it is important to explore how these patterns affect different groups of individuals. For example, historically marginalized populations like women and underrepresented racial and ethnic minorities may benefit more from majoring in fields closely linked to jobs in the labor market than historically privileged populations. If so, encouraging historically marginalized populations to major in fields closely linked to jobs in the labor market may help close gaps in wages and unemployment rates between more and less advantaged individuals.

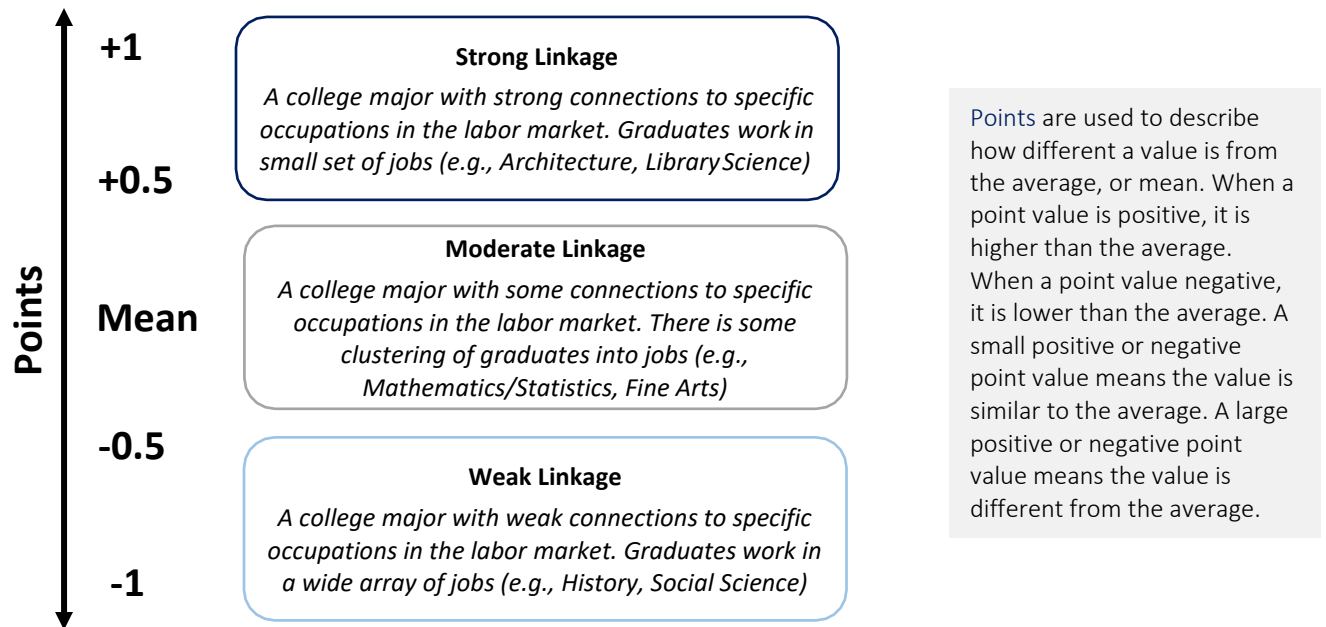
DEFINITIONS USED IN THE STUDY

Linkage This term describes the connection between a college major and specific occupations in the labor market. If individuals with the same college major tend to work in a small set of occupations, then the college major shows strong linkage. Please see Appendix B for additional explanation as well as the methodology.

Match Individuals are considered *matched* if they are employed in occupations common among people who hold their college major. Please see Appendix B for additional explanation as well as the methodology.

Background

Understanding Linkage Scores



Examples of College Majors and Linkage Scores

Strong Linkage	Moderate Linkage	Weak Linkage
<ul style="list-style-type: none">• Nuclear Technologies• Cosmetology/Culinary Arts• Electrical/Mechanical Repairs• Library Science• Construction• Transportation	<ul style="list-style-type: none">• Fine Arts• Engineering Technologies• Agriculture• Consumer Science• Mathematics/Statistics• Biological Science	<ul style="list-style-type: none">• Liberal Arts• Social Science• History• Linguistics/Languages• Psychology• Business

Study Purpose

This study sought to understand how **linkage** — the connections between college majors and specific occupations in the labor market — affected wages and unemployment rates. First, the analyses examined whether certain individuals were more or less likely to major in a field with strong linkage. Second, the analyses examined whether certain individuals were more or less likely to **match** — work in an occupation common among people with their college major.

Next, the analyses tested whether linkage was positively or negatively associated with wages and unemployment rates. The wage analyses distinguished the role of linkage by match in order to further test how college major linkage was or was not limited by occupation choice. Additional analyses examined whether the role of linkage varied by individual background characteristics — age, gender, race/ethnicity, nativity, and language. These analyses might shed light on whether certain groups benefitted more or less from majoring in a field with strong connections to the labor market. If so, the findings might have implications for employment inequality and how higher education practitioners work with students to choose college majors and set career goals.

The study asked the following research questions:

1. Which groups of people were more likely to enter strongly linked majors?
2. Which groups of people were more likely to work in a matched occupation?
3. What was the role of linkage strength and match in wages? How did linkage strength and match jointly affect wages? How did this vary by age, gender, race/ethnicity, nativity, and language?
4. What was the role of linkage strength in unemployment? How did this vary by age, gender, race/ethnicity, nativity, and language?

To address these questions, this study used microdata from the American Community Survey 5-Year Sample, 2013-2017. The study focused on adults 25-64 years old who held a bachelor's degree and resided in the state of Texas (N = 114,792 for earnings analyses, N = 112,719 for unemployment analyses). Details on the data, sample, and analytic strategy are available in Appendix B.

Findings

1

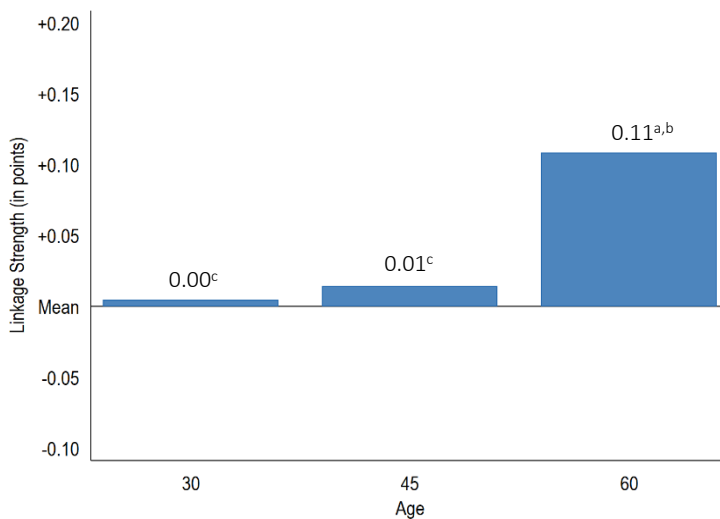
Workers who were older, female, Asian, foreign-born, and non-native English-speakers were more likely to complete a college major with higher linkage.

Research Question 1: Which groups of people were more likely to enter strongly linked majors?¹

Workers who were older, female, Asian, foreign-born, and non-native English-speakers were more likely to complete a college major with higher linkage than workers who were younger, male, white, Black, Hispanic, U.S.-born, and native English-speakers.²

In each graph, the y-axis shows the linkage strength: higher values mean the worker chose a college major tightly connected to specific occupations in the labor market, while lower values mean the worker chose a college major loosely connected to specific occupations in the labor market.³

Figure 1.1. Major-Occupation Linkage Strength by Age



a Significantly different from Age 30

b Significantly different from Age 45

c Significantly different from Age 60

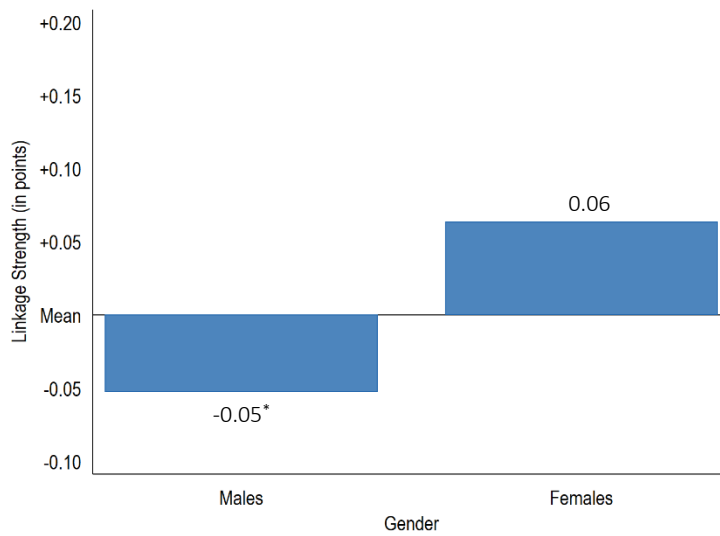
¹ The analyses were limited to individuals whose highest credential was a bachelor's degree and who reported positive earnings in the previous year. See Appendix B for additional details on sample selection.

² Full regression results are available in Appendix C.

³ Please note the linkage variable was standardized; see the Understanding Linkage Scores graphic on page three for guidance on interpretation. Details on how linkage was calculated are available in Appendix B.

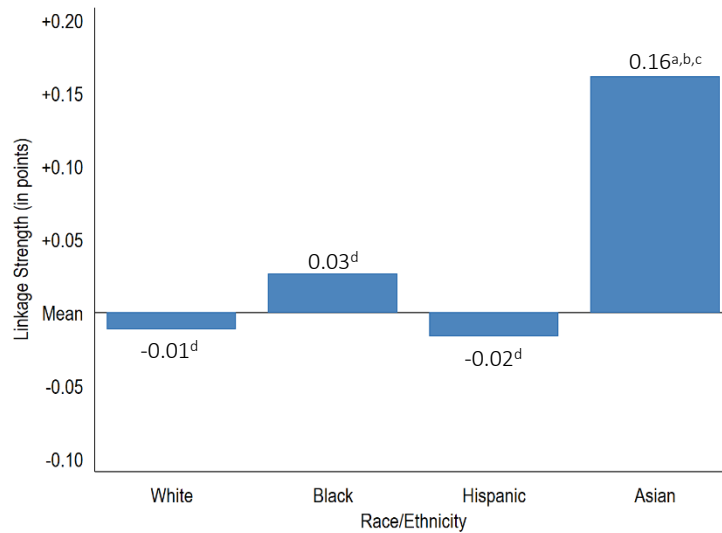
Findings

Figure 1.2. Major-Occupation Linkage Strength by Gender



* Significant difference between groups

Figure 1.3. Major-Occupation Linkage Strength by Race/Ethnicity



a Significantly different from White

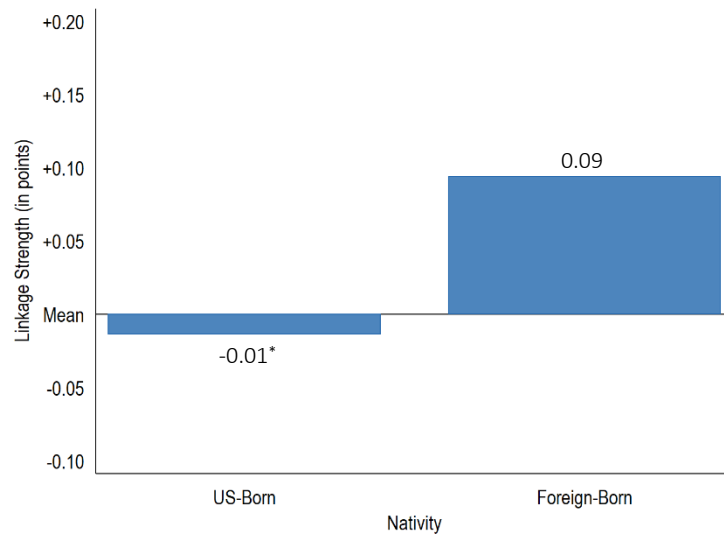
b Significantly different from Black

c Significantly different from Hispanic

d Significantly different from Asian

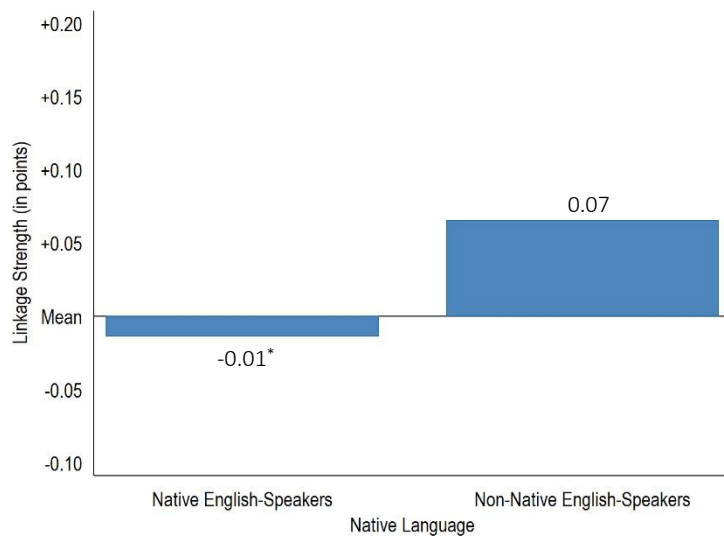
Findings

Figure 1.4. Major-Occupation Linkage Strength by Nativity



* Significant difference between groups

Figure 1.5. Major-Occupation Linkage Strength by Language



* Significant difference between groups

Age – Figure 1.1

- Workers who were 60 years old majored in fields more strongly linked to specific occupations in the labor market (0.11 points) than 30-year-old (0.00 points) and 45-year-old (0.01 points) workers.⁴
- Differences between 30-year-old and 45-year-old workers were not statistically significant.

Gender – Figure 1.2

- Females (0.06 points) were more likely than males (-0.05 points) to major in a field with strong linkage to specific occupations in the labor market.

Race/Ethnicity – Figure 1.3

- Asian workers were more likely to major in a field strongly linked to specific occupations in the labor market (0.16 points) than white (-0.01 points), Black (0.03 points), and Hispanic (-0.02 points) workers.
- Differences between white, Black, and Hispanic workers were not statistically significant.

Nativity – Figure 1.4

- Foreign-born workers majored in fields characterized by higher linkage (0.09 points) than U.S.-born workers (-0.01 points).

Language – Figure 1.5

- Non-native English-speakers majored in fields characterized by higher linkage (0.07 points) than native English-speakers (-0.01 points).

⁴ Linkage was calculated using contemporary data on majors and occupations. The findings reflected workers' current job, not their first job after college.

2

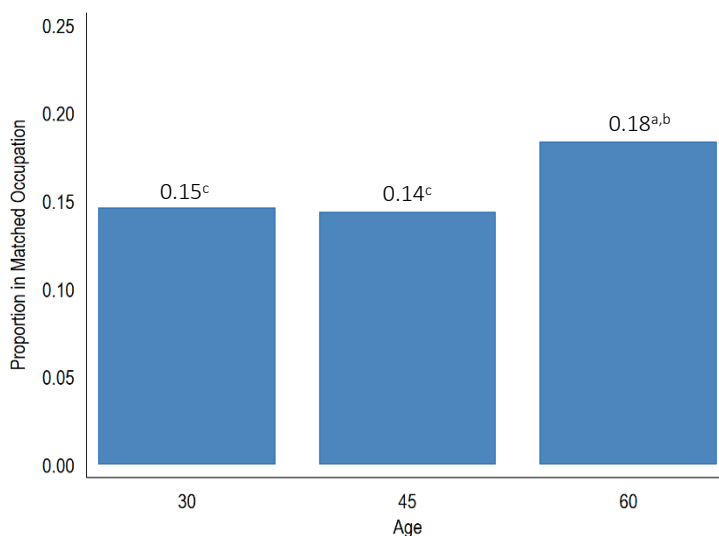
Only 14 percent of workers were employed in a matched occupation.

Research Question 2: Which groups of people were more likely to work in a matched occupation?⁵

Only 14 percent of workers were employed in a matched occupation. Workers who were older, female, Asian, and U.S.-born were more likely to be employed in a matched occupation than workers who were younger, male, white, Black, Hispanic, and foreign-born. For the study, a matched occupation was defined as the top-two most common occupations of a given college major (e.g., for an architecture major, these occupations would be architect and urban or regional planner).^{6,7}

In each graph, the y-axis shows the probability of working in a matched occupation. The y-axis values can also be interpreted as percentages; a value of 0.05 corresponds to five percent.

Figure 2.1. Proportion of Workers in Matched Occupations by Age



a Significantly different from Age 30

b Significantly different from Age 45

c Significantly different from Age 60

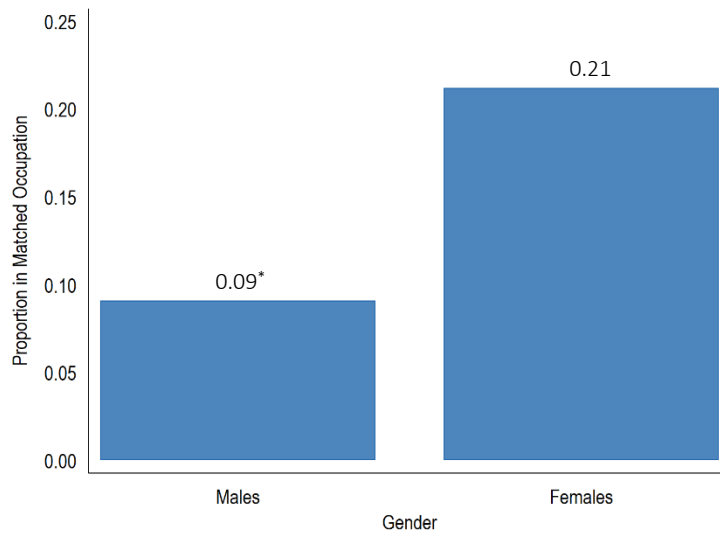
⁵ The analyses were limited to individuals whose highest credential was a bachelor's degree and who reported positive earnings in the previous year. See Appendix B for additional details on sample selection.

⁶ Details on how match was calculated are available in Appendix B. The definition of match was based on the approach used in Bol et al. (2019). In that study, the authors defined match as the top-two most common occupations of a given college major. In robustness checks, the authors defined match as the top-one, top-three, and top-four most common occupations. They noted that "[w]hile the results remain qualitatively similar, it also becomes clear that using a more narrow definition of 'match' (i.e., 2 or 3 occupations) seems slightly more predictive of labor market earnings."

⁷ Full regression results are available in Appendix D.

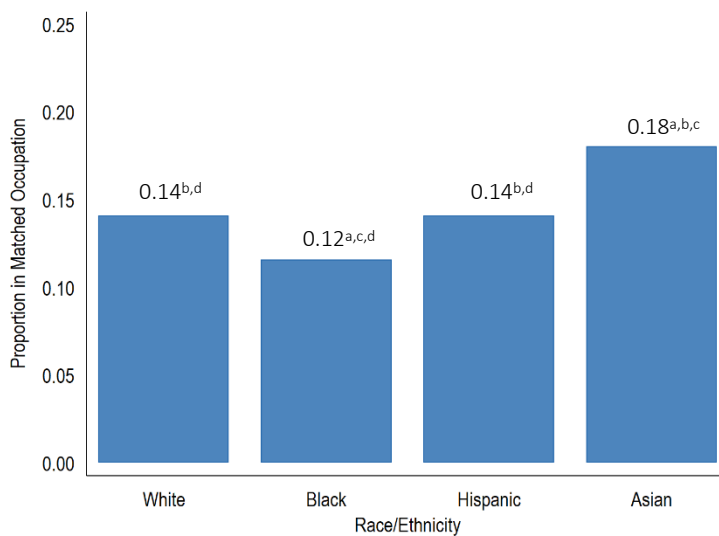
Findings

Figure 2.2. Proportion of Workers in Matched Occupations by Gender



* Significant difference between groups

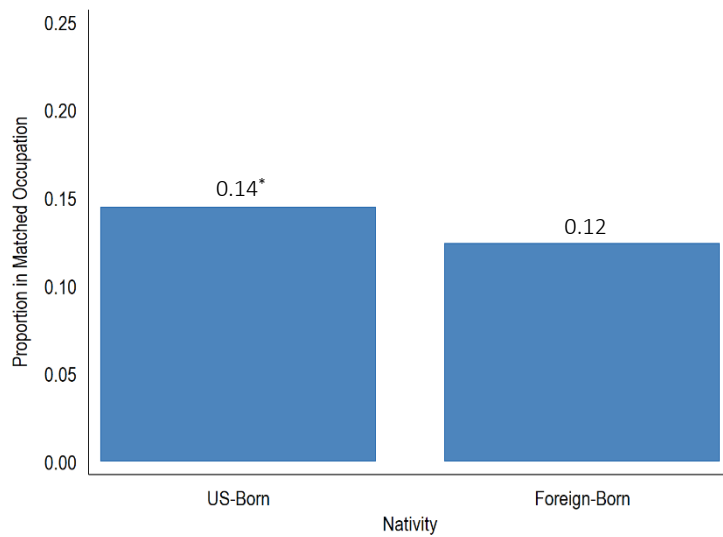
Figure 2.3. Proportion of Workers in Matched Occupations by Race/Ethnicity



- a Significantly different from White
- b Significantly different from Black
- c Significantly different from Hispanic
- d Significantly different from Asian

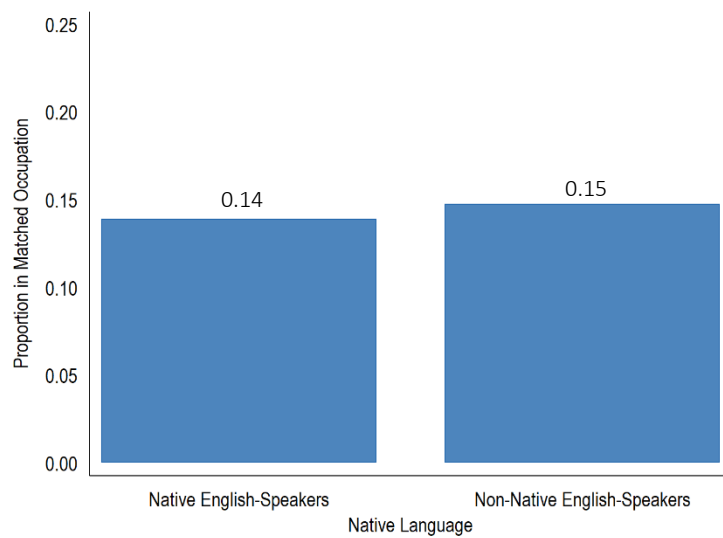
Findings

Figure 2.4. Proportion of Workers in Matched Occupations by Nativity



* Significant difference between groups

Figure 2.5. Proportion of Workers in Matched Occupations by Language



* Significant difference between groups

Age – Figure 2.1

- Workers who were 60 years old were more likely to work in a matched occupation (18%) than 30-year-old (15%) and 45-year-old (14%) workers.⁸
- Differences between 30-year-old and 45-year-old workers were not statistically significant.

Gender – Figure 2.2

- Compared to males (9%), females were more likely to work in a matched occupation (21%).

Race/Ethnicity – Figure 2.3

- Asian workers had the highest rates of occupational match (18%), and were more likely to be employed in a matched occupation than white (14%), Black (12%), and Hispanic (14%) workers.
- White and Hispanic workers were more likely to work in a matched occupation than Black workers.
- Differences between white and Hispanic workers were not statistically significant.

Nativity – Figure 2.4

- U.S.-born workers were more likely to work in a matched occupation (14%) than foreign-born workers (12%).

Language – Figure 2.5

- There was no significant difference in the likelihood of working in a matched occupation by language. Native English-speakers (14%) and non-native English-speakers (15%) were employed in matched occupations at similar rates.

⁸ Match was calculated using current data on majors and occupations. The findings reflected workers' current job, not their first job after college.

3

Strong linkage increased the wages of workers in matched occupations more than workers not in matched occupations.

Research Question 3: What was the role of linkage strength and match in wages? How did linkage strength and match jointly affect wages? How did this vary by age, gender, race/ethnicity, nativity, and language?⁹

The third part of the analyses found college major linkage strength and occupational match were positively related to wages. In particular, strong linkage increased the wages of workers in matched occupations more than workers not in matched occupations.¹⁰

In the following graphs, the y-axis shows the predicted wage of workers, while the x-axis shows the standardized linkage strength score of workers' college majors. In each graph, there are separate lines which plot the relationship between linkage strength and wages for (1) workers employed in a matched occupation (dashed red line) and (2) workers who were not employed in a matched occupation (solid blue line).¹¹

Figure 3.1 illustrates how linkage strength and match predicted wages. While linkage strength was positively associated with wages, it showed a stronger relationship for workers employed in matched occupations than workers not employed in matched occupations. This is evident by the fact that the slope of the in matched occupation line (dashed red line) is steeper than the slope of the not in matched occupation line (solid blue line). This means linkage strength benefitted workers, but the benefits were more pronounced for workers employed in occupations related to their college major.

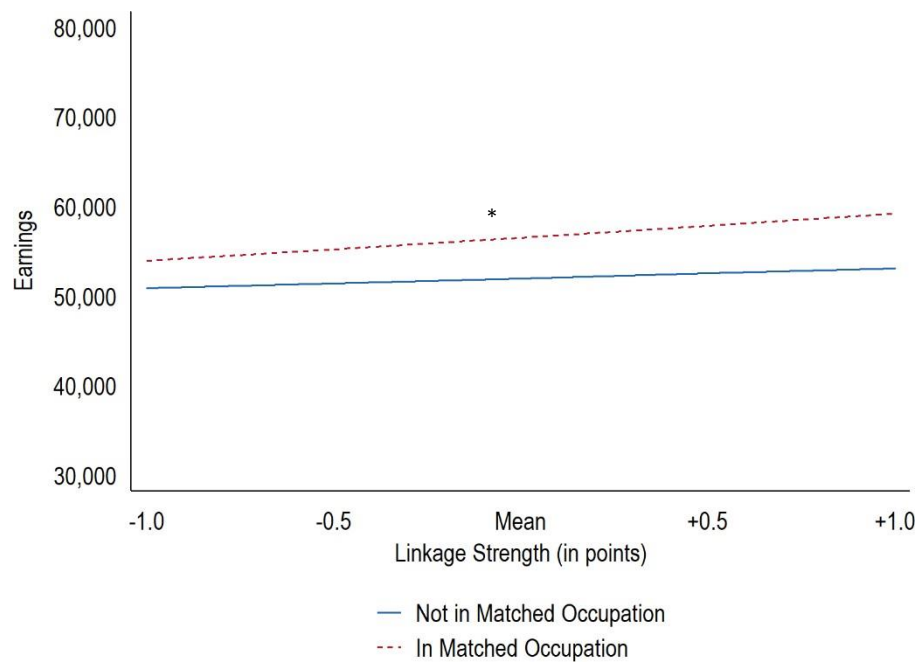
Regardless of linkage strength, workers who were employed in a matched occupation earned higher wages than workers who were not employed in a matched occupation, net of other background characteristics. For example, at the mean linkage value, workers in matched occupations earned \$56,519 annually, while workers not in matched occupations earned \$51,980.

⁹The analyses were limited to individuals whose highest credential was a bachelor's degree and who reported positive earnings in the previous year. See Appendix B for additional details on sample selection.

¹⁰Details on the statistical modeling are available in Appendix B. Full regression results are available in Appendix D.

¹¹As discussed earlier, the potential benefits of choosing a college major with strong linkage might only apply to individuals who were in matched occupations, or jobs common among people with their major.

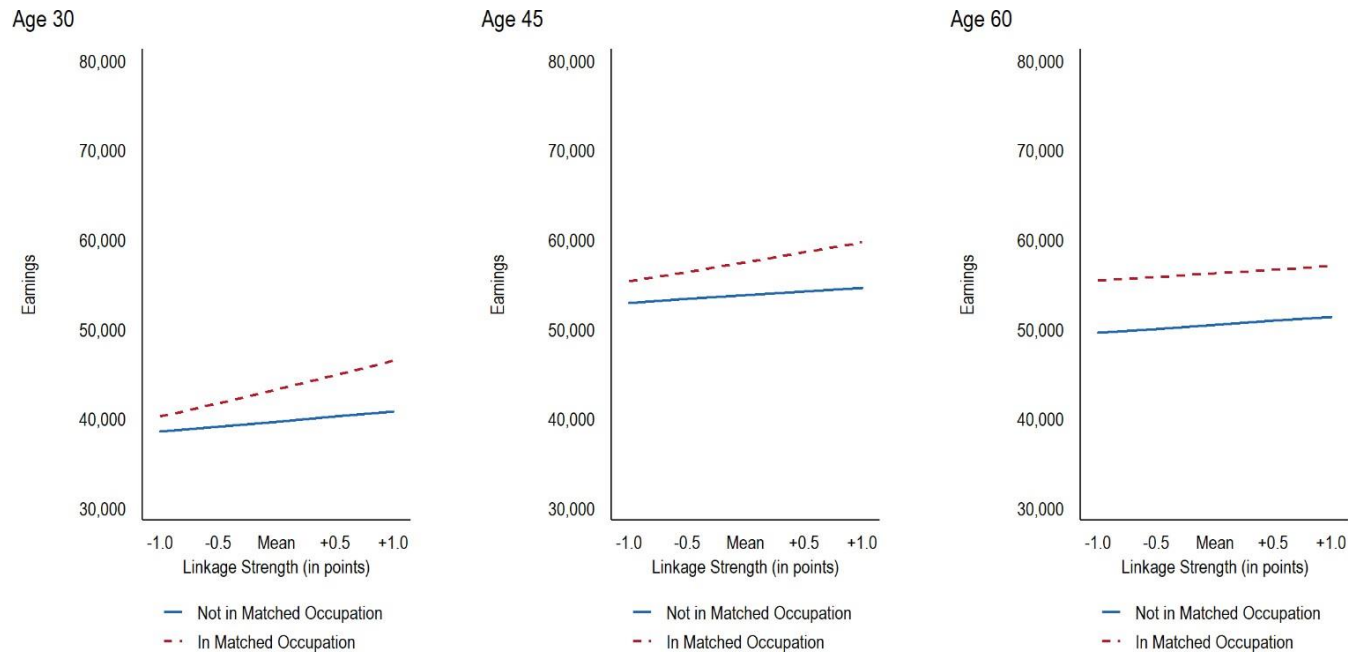
Figure 3.1. Earnings by Linkage Strength and Match



* Slopes were significantly different

Findings

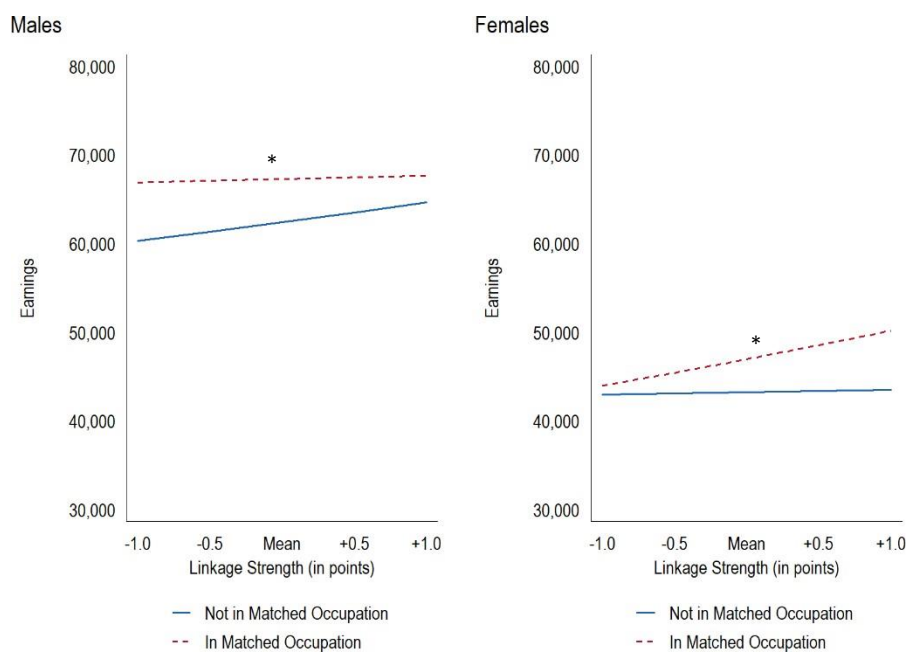
Figure 3.2. Earnings by Linkage Strength, Match, and Age



Note: The research team was unable to provide a formal statistical test of within-group comparisons. Please contact the authors for additional details.

Findings

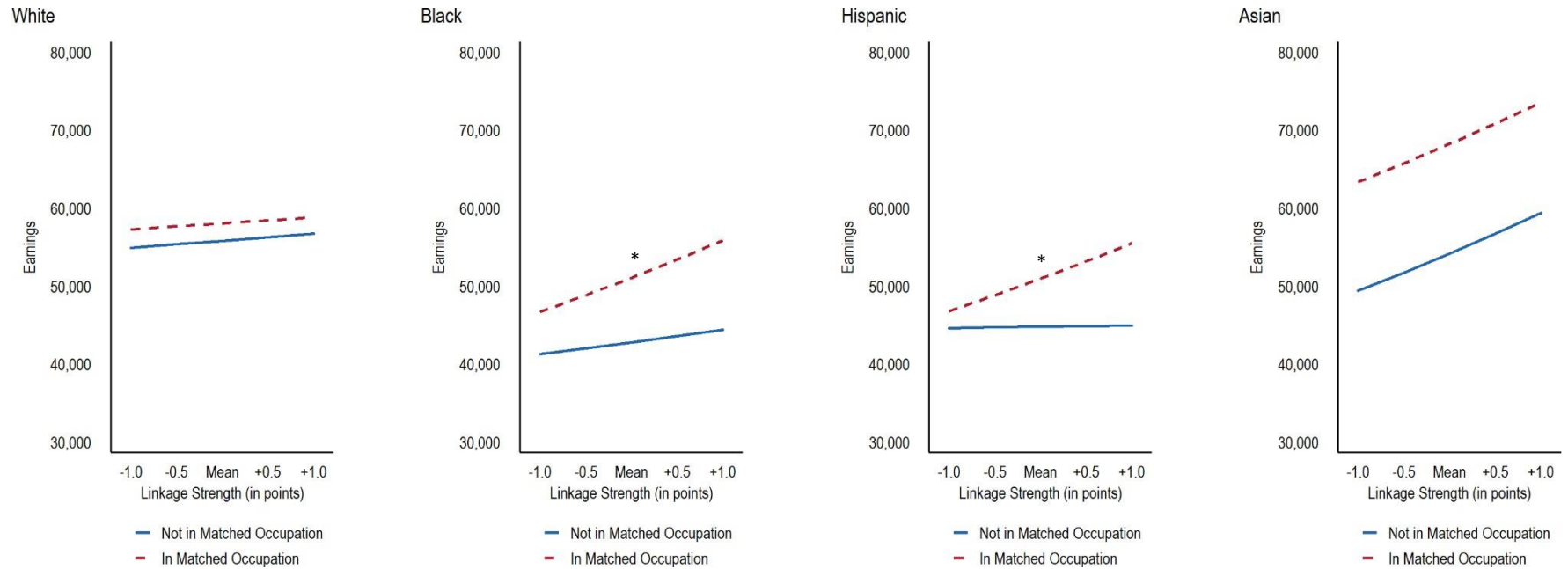
Figure 3.3. Earnings by Linkage Strength, Match, and Gender



* Within-group comparison: slopes were significantly different

Findings

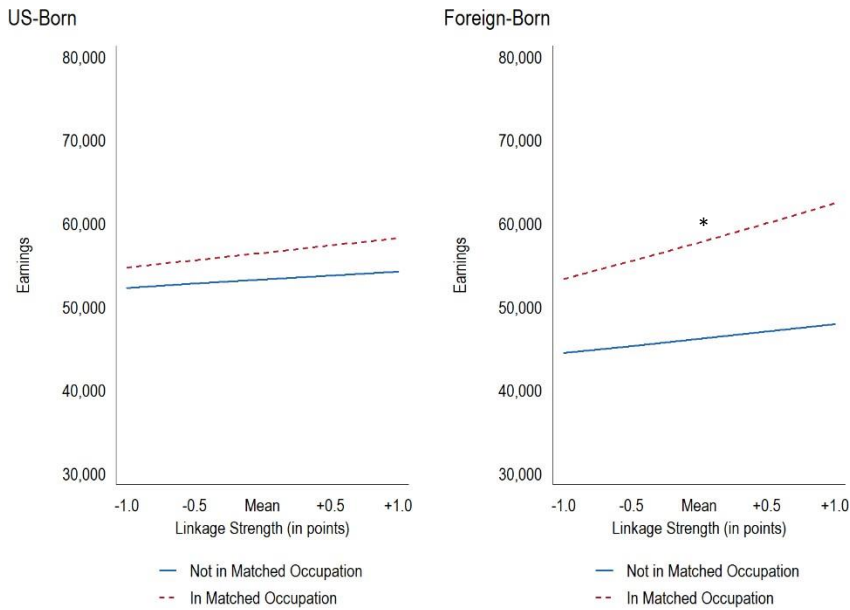
Figure 3.4. Earnings by Linkage Strength, Match, and Race/Ethnicity



* Within-group comparison: slopes were significantly different

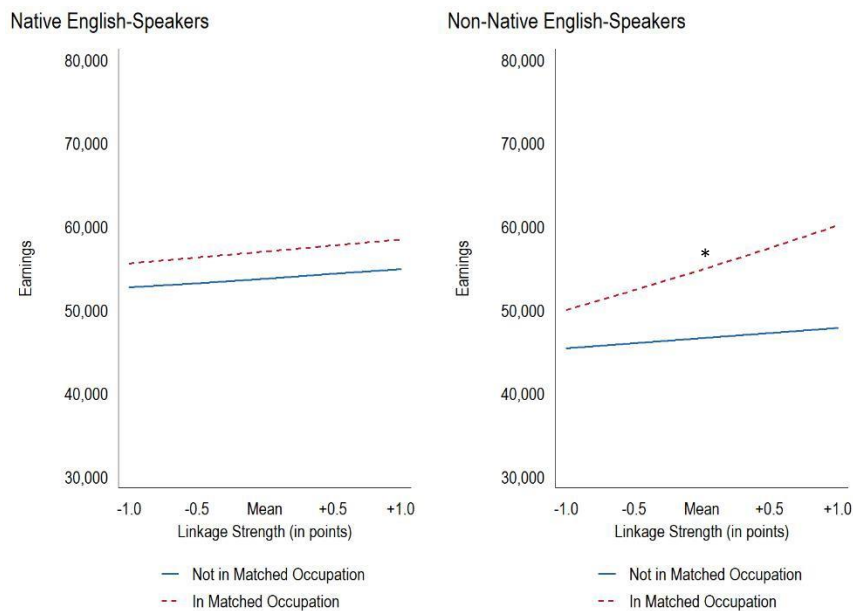
Findings

Figure 3.5. Earnings by Linkage Strength, Match, and Nativity



* Within-group comparison: slopes were significantly different

Figure 3.6. Earnings by Linkage Strength, Match, and Language



* Within-group comparison: slopes were significantly different

Age – Figure 3.2

- At ages 30, 45, and 60, workers earned higher wages if their college major had high linkage strength and if they were employed in a matched occupation.¹²

Gender – Figure 3.3

- Women who completed college majors in fields loosely connected to specific occupations in the job market (-1.00 points) earned similar wages, regardless of whether they were employed in a matched (\$43,971) or unmatched (\$42,989) occupation.
- Linkage appeared to increase the wages of women in matched occupations only.
- Although men in matched occupations tended to earn higher wages than men in unmatched occupations, men in matched occupations saw little benefit from linkage strength.
- In contrast, men in unmatched occupations benefitted from higher linkage.

Race/Ethnicity – Figure 3.4

- Black and Hispanic workers in matched occupations appeared to benefit from linkage strength.
- Black workers not in matched occupations also benefitted from linkage strength, but to a much lesser degree.
- Compared to Black and Hispanic workers in matched occupations, white workers in matched occupations benefitted less from high linkage. In fact, the role of linkage for white workers did not differ by match; matched and unmatched workers benefitted from linkage at similar magnitudes.
- Asian workers, in particular, saw significant wage increases from working in a matched occupation. Among Asian workers who majored in fields characterized by low levels of linkage (-1.00 points), the wage differential between matched and unmatched workers was \$13,920.
- While Asian workers benefitted from majoring in fields with high levels of linkage, the role of linkage did not vary by match.

¹² Linkage was calculated using contemporary data on majors and occupations. The findings reflected workers' current job, not their first job after college.

Nativity – Figure 3.5

- Foreign-born workers experienced large wage increases by working in a matched occupation. Among foreign-born workers with college majors in fields characterized by low levels of linkage (-1.00 points), workers in matched occupations earned \$8,874 more than workers in unmatched occupations.
- Linkage appeared to increase the wages of all workers, regardless of nativity and match. However, it benefitted foreign-born workers in matched occupations the most.
- For U.S.-born workers, the benefits of linkage were smaller and did not vary by occupational match.

Language – Figure 3.6

- Non-native English-speakers appeared to benefit from working in a matched occupation, relative to working in an unmatched occupation, and this wage premium increased at higher linkage strength scores.
- While working in a matched occupation increased wages for native English-speakers, the role of linkage did not vary by occupational match.

4

Linkage negatively predicted unemployment.

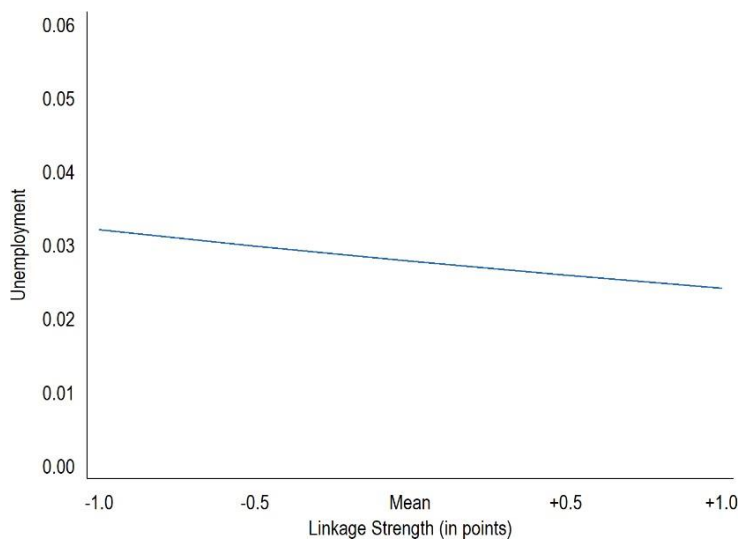
Research Question 4: What was the role of linkage strength in unemployment? How did this vary by age, gender, race/ethnicity, nativity, and language?¹³

Linkage negatively predicted unemployment.^{14,15}

In the following graphs, the y-axis shows the probability of unemployment. Y-axis values may be interpreted as percentages; a value of 0.05 corresponds to five percent. The x-axis shows the standardized linkage strength score of college majors. As a reminder, if an individual's college major exhibits tight connections to jobs in the labor market, their major will have higher linkage. In contrast, if an individual's college major exhibits loose connections to jobs in the labor market, their major will have lower linkage.

Figure 4.1 shows individuals who chose college majors with strong linkage were less likely to be unemployed. Individuals who had college majors with weak linkage scores (-1.00 points) had a 3.2 percent likelihood of unemployment, while individuals who had college majors with strong linkage scores (1.00 points) were less likely to be unemployed, at a rate of 2.4 percent.

Figure 4.1. Unemployment by Linkage Strength

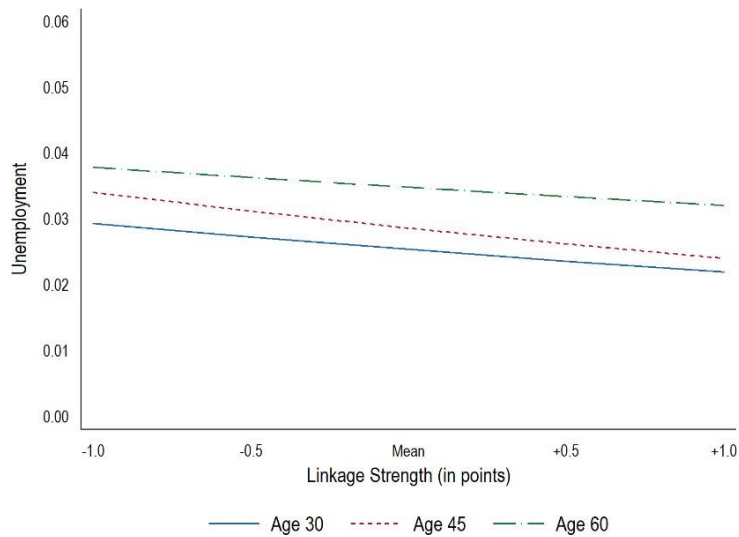


¹³ The analyses were limited to individuals whose highest credential was a bachelor's degree and who were in the labor force. See Appendix B for additional details on sample selection.

¹⁴ The statistical models did not incorporate the match variable. The match variable was based on individuals' current occupation and unemployed individuals might not list an occupation.

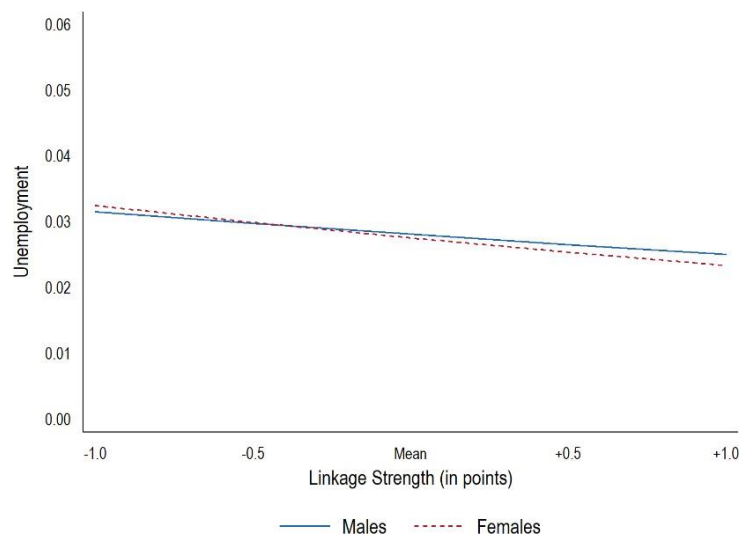
¹⁵ Details on the statistical modeling are available in Appendix B. Full regression results are available in Appendix E.

Figure 4.2. Unemployment by Linkage Strength and Age



Note: The research team was unable to provide a formal statistical test of slope comparisons. Please contact the authors for additional details.

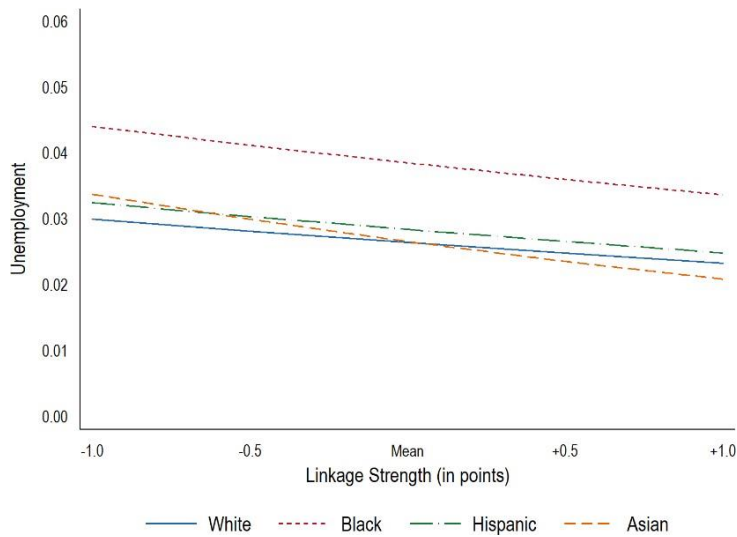
Figure 4.3. Unemployment by Linkage Strength and Gender



* Slopes were significantly different

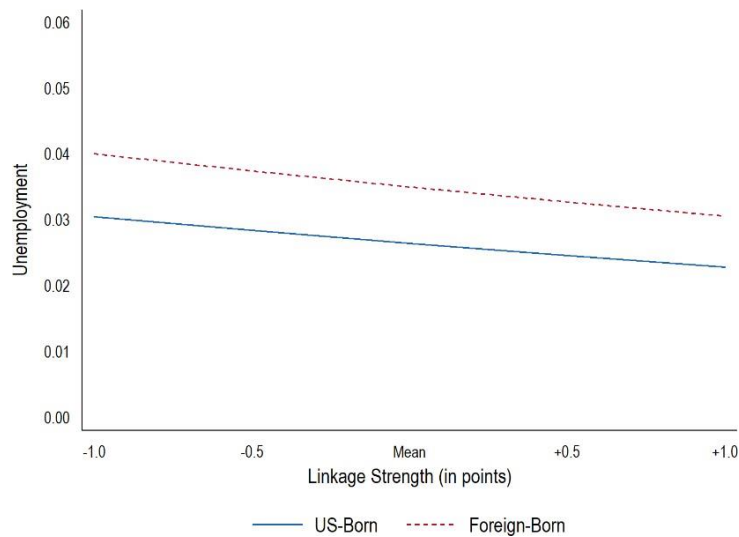
Findings

Figure 4.4. Unemployment by Linkage Strength and Race/Ethnicity



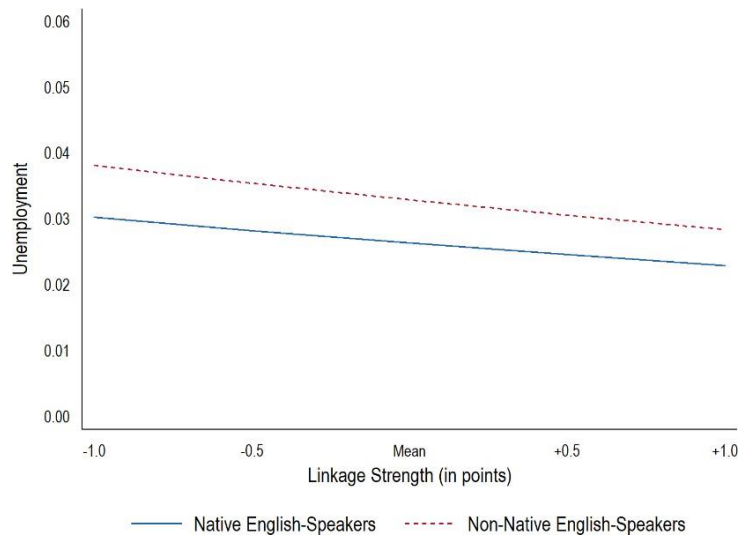
- a Slope was significantly different from White slope
- b Slope was significantly different from Black slope
- c Slope was significantly different from Hispanic slope
- d Slope was significantly different from Asian slope

Figure 4.5. Unemployment by Linkage Strength and Nativity



* Slopes were significantly different

Figure 4.6. Unemployment by Linkage Strength and Language



* Slopes were significantly different

Age – Figure 4.2

- While younger individuals were less likely to be unemployed than older individuals, individuals at all ages were less likely to be unemployed if their college major was strongly linked to specific occupations in the labor market.¹⁶

Gender – Figure 4.3

- Linkage was negatively associated with unemployment for both men and women.
- Men and women appeared to have similar rates of unemployment, regardless of the linkage strength of their college majors.

Race/Ethnicity – Figure 4.4

- Black individuals were more likely to be unemployed than white, Hispanic, and Asian individuals, regardless of the linkage strength of their college majors.
- Nevertheless, for all races and ethnicities, completing a college major with strong linkage reduced the likelihood of unemployment.
- Differences between groups were not statistically significant.

Nativity – Figure 4.5

- Individuals born outside the U.S. were more likely to be unemployed than U.S.-born individuals.
- Linkage strength exhibited a negative relationship with unemployment for both the foreign- and U.S.-born.
- Differences between the two groups were not statistically significant.

Language – Figure 4.6

- Non-native English-speakers were more likely to be unemployed than native English-speakers.
- Regardless of language, completing a college major with strong linkage lowered the likelihood of unemployment.
- Differences between the two groups were not statistically significant.

¹⁶ Linkage was calculated using contemporary data on majors and occupations. The findings reflected individuals' current employment status, not their first employment status after college.

Conclusion

The results showed background characteristics like age, gender, race/ethnicity, nativity, and language predicted whether an individual majored in a field with close ties to the job market and whether they entered an occupation related to their major. Group differences in linkage and match were worth exploring because the analyses found linkage and match predicted earnings and unemployment.

Overall, linkage was positively associated with wages, particularly for individuals employed in a matched occupation. Linkage was also negatively associated with unemployment. These findings highlighted how some majors might have clearer pathways into the labor market. While the role of linkage in *unemployment* did not vary by age, gender, race/ethnicity, nativity, and language, linkage showed different relationships with *earnings* for these groups. For example, groups historically underserved in the labor market like women and racial and ethnic minorities appeared to benefit from linkage and match to a greater extent than more privileged groups. Although male, white, U.S.-born, and native English-speaking individuals might have more advantages in the workforce, these gaps might narrow if individuals majored in fields with strong connections to the labor market and worked in occupations tied to their college majors.

Recommendations

For education policymakers and researchers

- Education policymakers and researchers ought to explore why students choose college majors tightly or loosely connected to the job market and why some students find employment in a matched occupation, while others do not.

For colleges and universities in collaboration with employers

- Higher education practitioners can use the information from this report and other research to develop new strategies to help students understand the career pathways of their college majors and their connections to the labor market.
- College career placement and academic department staff can collaborate with employers to help students, particularly those from historically underserved backgrounds, obtain jobs in occupations related to their college majors.

References

- Bol, T., Ciocca Eller, C., van de Werfhorst, H. G., & DiPrete, T. A. (2019). School-to-Work Linkages, Educational Mismatches, and Labor Market Outcomes. *American Sociological Review*, 84(2), 275–307.
- DiPrete, T. A., Bol, T., Eller, C. C., & van de Werfhorst, H. G. (2017). School-to-Work Linkages in the United States, Germany, and France. *American Journal of Sociology*, 122(6), 1869–1938.
- Holzman, B., Gul, M., Salazar, E. S., & Kennedy, C. C. (2020). *Transitioning to College and Work (Part 3: Labor Market Analyses in Houston and Texas)*. Houston, TX: Houston Education Research Consortium, Kinder Institute for Urban Research, Rice University.
- Texas Higher Education Coordinating Board. (2015). *60x30TX: Texas Higher Education Strategic Plan: 2015-2030*. Austin, TX: Texas Higher Education Coordinating Board. Retrieved August 29, 2016, from <http://www.thecb.state.tx.us/reports/PDF/6862.PDF?CFID=46806174&CFTOKEN=16179922>

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Note on the authors. Irina Chukhray, M.A. is currently a doctoral student at the University of California-Davis.

About HERC. Focusing on the most pressing challenges facing the region, the Houston Education Research Consortium (HERC) is a research-practice partnership between Rice University and 11 Houston-area school districts. HERC research is developed directly alongside district leaders with findings shared with decision makers – culminating in long-term, equity-minded solutions, opportunities and growth for Houston and beyond.



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